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LOWER FLATHEAD SYSTEM FISHERIES STUDY

Executive Summary, Volume I

Final Report 1983

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LOWER FLATHEAD SYSTEM FISHERIES STUDY
Executive Summary, Volume I

Final Report FY 1983 - 1987

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PREFACE

This Executive Summary Volume I, of the lower Flathead System Fisheries Study Final Report, was prepared to provide a study overview for persons who are not fisheries scientists, although the report will also be of use to technical persons interested in the scope and summary findings of the study. The contents provide an introduction to the study and its objectives, a short description of the study area, a discussion of the major findings and conclusions of the study, and the description of fisheries managePnent alternatives available to managers of the lower Flathead system. Technical reports were prepared for those portions of the study dealing with the lower Flathead River and its tributaries, Volume II, and the South Bay of Flathe& Lake, Volume III.

The Tribes in cooperation with the Montana Department of Fish, Wildlife and Parks will be developing an interagency fisheries mitigation protection plan (IMP), which will be presented to the Northwest Power Planning Council in October of 1989. This plan will incorporate the findings and recanmendations from all the Flathead Basin fisheries studies, producing a comprehensive, basin wide, management and mitigation plan.

INTRODUCTION

Montana's Flathead River-Lake ecosystem, with tributaries originating in Canada, Glacier National Park, and the Bob Marshall Wilderness is internationally known for its clean, clear waters and near pristine conditions and constitutes the northeastern Most drainage of the Colunrbia River (Figure 1). Historically the Flathead River-Lake system of northwestern Montana represented a major natural resource to the Indian people of the Salish and Kootenai Tribes. It remains so today, providing food, recreation, scenic grandeur, and economic benefit to the Tribes, other residents, and visitors to the Flathead Reservation. Sound management of the fish and wildlife resources of the lower Flathead system, in conjunction with hydroelectric power production, is of vital interest to all and especially the Tribes.

The Lower Flathead System Fisheries Study, funded by Bonneville Power Administration, resulted from program measures 804 (a)(3) and (b)(6) adopted by the Northwest Power Planning Council for the Columbia Basin Fish and Wildlife Program. The study was conducted by biologists of the Confederated Salish and Kootenai Tribes. Close coordination with other basin investigations was maintained throughout the study.

Many additional studies in the Flathead basin dealing with Kerr and Hungry Horse Dams presently are being conducted; all have bearing on aquatic resource conservation and management, and relate to the management strategies discussed in this report (Cross 1987). The Montana Department of Fish, Wildlife and Parks is conducting studies on kokanee salmon in Flathead Lake (Decker-Hess and Clancey 1984) and upper Flathead River (Fraley 1984), and on Canada geese (Branta canadensis moffitti) (Casey et al. 1985) in the northern Flathead Valley. Canada geese in the southern Flathead valley are being studied by the Confederated Salish and Kootenai Tribes (Mackey et al. 1985). Staff of the Flathead Lake Biological Station are studying the aquatic insects of the lower Flathead River, how they may be influenced by hydroelectric oprations, and the implications to fisheries management, under contract with the U.S. Bureau of Indian Affairs (Hauer and Potter 1986). Wherever possible the results of these studies have been intqratti into this report.

The annual hydrographic regime of the Flathead system, consisting of upper rivers, lake and lower river, has been modified by the construction and operation of two major hydroelectric facilities, Hungry Horse Dam on the south fork Flathead River and Kerr Dam at the outlet of Flathead Lake(Figure 2). The modified hydrographic regime has resulted in significant impacts to kokanee (Oncorhvncl?us nerka) and several species of trout (Decker-Hess and Clancey, 1984; Fraley and McMullin 1983, Darling et al. 1984).

Kerr Dam, closed in 1938, controls Flathead Lake levels between 878.7 m (2883 ft) and 881.8 m (2893 ft) and discharges into the lower Flathead River. Kerr Dam is a 63.4 m (208 ft) high concrete arch structure located 7.2 km (4.5 miles) downstream from the outlet of Flathead Lake. The facility is used by Montana Power Company primarily for system frequency load control with some use for low level *base load, and was jointly relicensed to Montana Power Company and the confederated Salish and Kootenai Tribes on 19 July 1985.

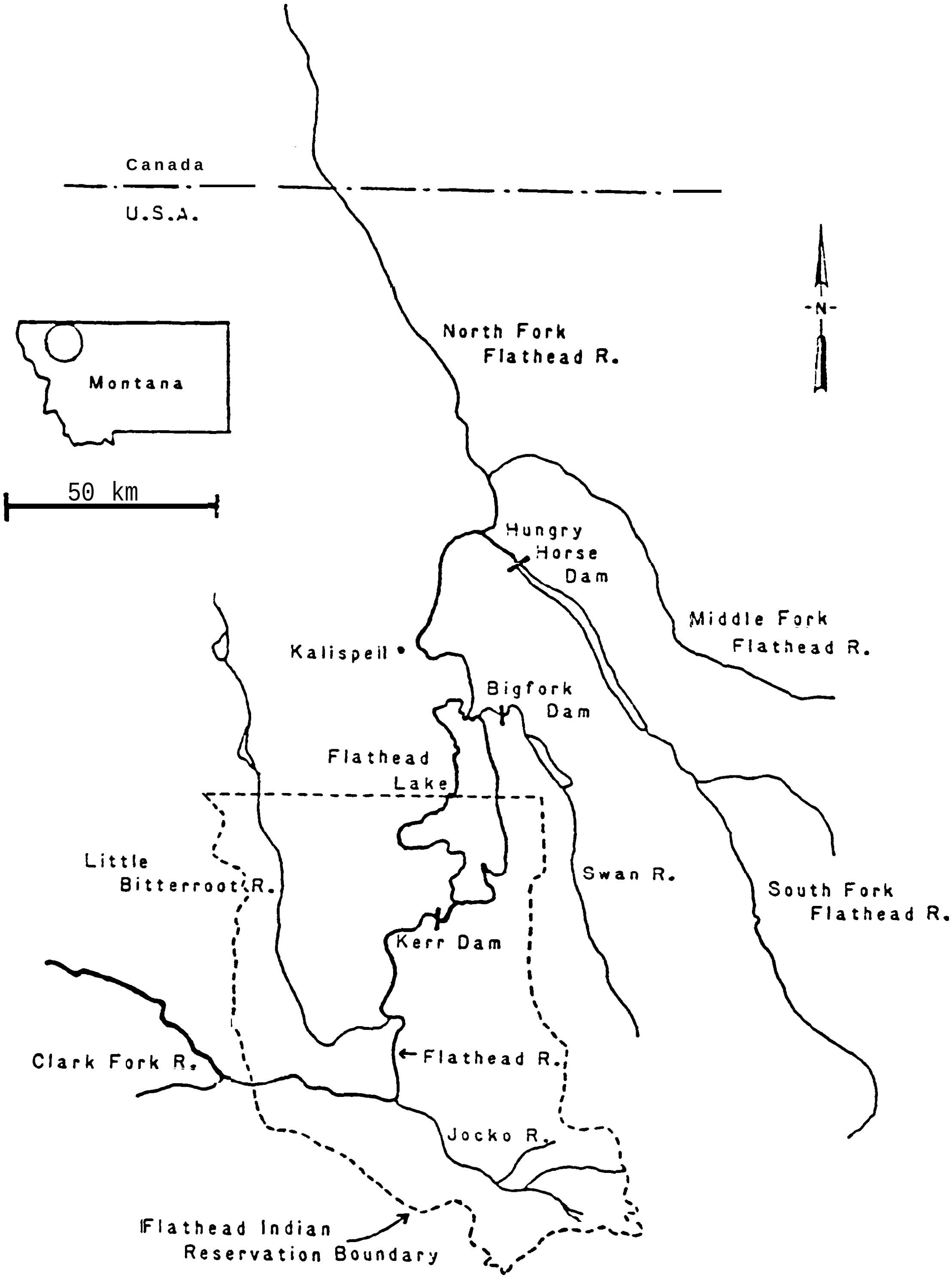

Figure 1. The Flathead River System, Montana.

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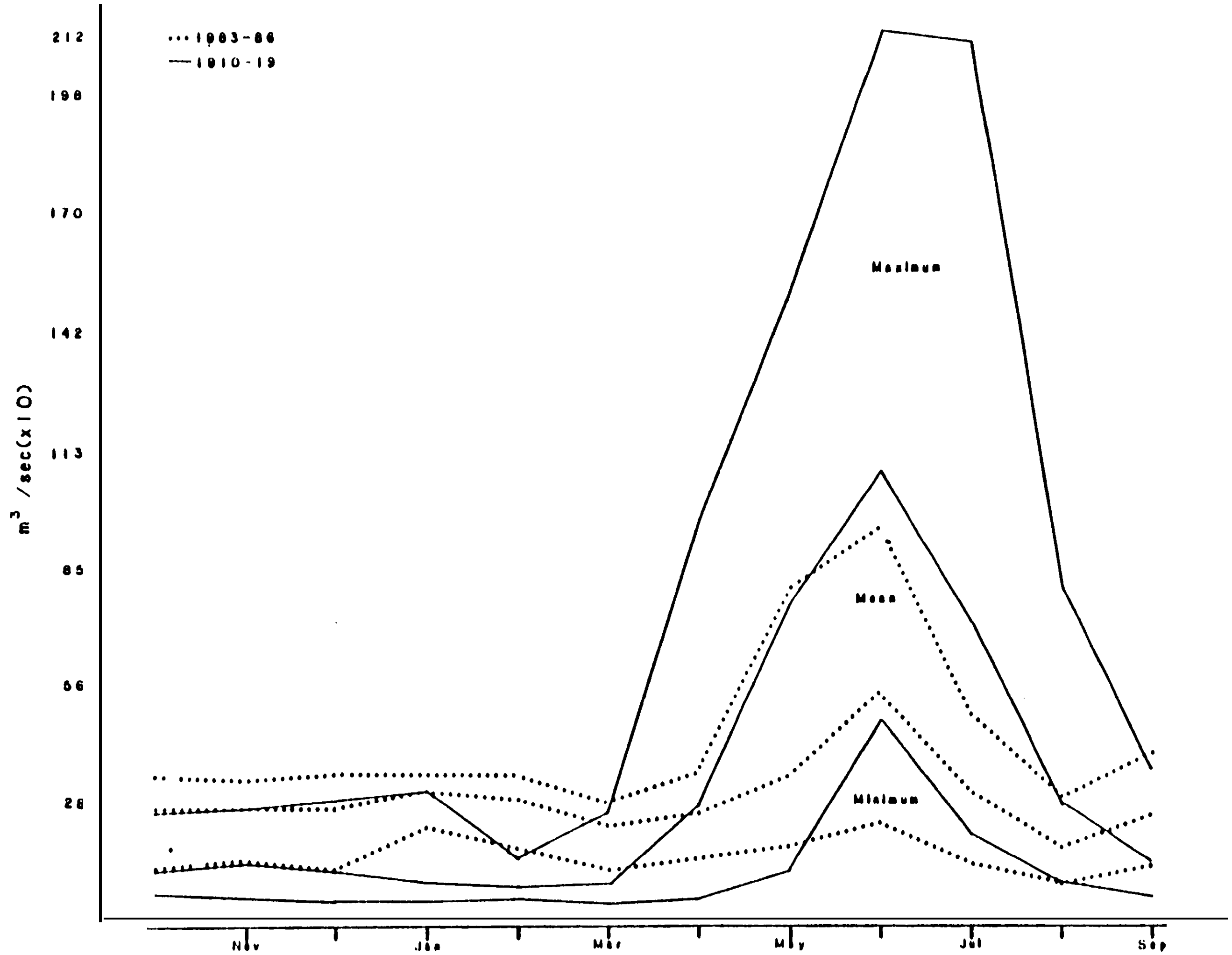

Figure 2. Pre- (1910-1919) and post-impoundment (1983-1986) average monthly discharges for the lower Flathead River recorded directly below Kerr Dam at the USGS gauge station established in 1907.

Hydroelectric peaking operations typically store water at night when power demand is low, and release water through turbine generators during the early morning and evening to satisfy peak energy demands. These operations result in rapidly varying discharge in the river below a peaking facility with constantly recurring impacts to the aquatic ecosystem, particularly the aquatic biota (Gislason 1985, Fraley and Graham 1982, Decker et al. 1981, Stanford and Hauer 1978, Hamilton and Buell 1976). Rapidly varying flows in streams reduce aquatic insect standing crop and diversity, decrease survival of fish eggs and alevin, reduce the condition factor of sport fish, select for species tolerant of flow fluctuations, strand fish, fish eggs, and aquatic insects, and modify thermal regimes (Cushman 1985, Stanford and Ward 1979).

The Lower Flathead System Fisheries Study began in December of 1982 with a pilot study which developed sampling methods, established permanent study sections, and a sampling schedule for the lower river and its tributaries (DosSantos et al. 1983). The study was expanded during 1984 to include the South Bay of Flathead Lake. Fisheries data were largely lacking on the lower Flathead system except for a general inventory in 1979 and annual spot checks by the United State Fish and Wildlife Service (Peterson 1977 and 1978; Randall 1980). This situation made assessment of historical loss problmtical at best. The study design focused on identification of impacts of existing dam operations upon aquatic habitat and populations of mountain whitefish (_Prosopium williamsoni_)r rainbow trout (_Salmo sairdneri_), cutthroat trout (Salmo _clarki_), brown trout (Salmo trutta)r brook trout (_Salvelinus fontinalis_), bull trout (_Salvelinus confluentus_) I northern pike (_Esox lucius_) and largemouth bass (_MicroPterus salmoides_) in the lower river system and yellow perch (_Perca flavescens_), lake whitefish (_Coreconus clupeaformis_) and largemouth bass (_Micropterus salmoides_) in South Bay.

The study was designed to provide sufficient biological and physical data on the fisheries resources of the lower Flathead system so that management strategies could be developed. The objectives of the study were to:

I. Assess existing aquatic habitat in the lower Flathead systen (South Bay, the lower Flathead River and its major tributaries) and its relationship to the present size, distribution, and maintenance of all trout species (including whitefish), northern pike, largemouth bass and yellow perch populations.

II. Assess how and to what extent hydroelectric development and operation affects the quality and quantity of aquatic habitat in the lower Flathead system and life stages of existing trout, pike, and largemouth bass populations. Evaluate the potential for increasing quality habitat, and thus game fish production, through operational changes or mitigation.

III. Develop an array of fisheries management options to mitigate the impacts of present hydroelectric operations, demonstrating under each management option how fish populations and hydroelectric generation capabilities would be modified. Additionally, consider possible future hydroelectric development and operation and its impacts on target species.

DESCRIPTION OF STUDY AREA

The Lower System study area consisted of the South Bay of Flathead Lake, the lower Flathead River from Kerr Dam to the confluence with the Clark Fork of the Columbia River, and the five major tributaries to the lower Flathead River: the Little Bitterroot River, Mission, Post and Crow Creeks and the Jocko River (Figure 1). The main river was divided into four major reaches: reach I containing the Buffalo study section; reach II containing the Sloan study section; reach III containing the Dixon and Weed study sections; and reach IV containing the Perm study section (Figure 4). On the Jocko River seven reaches were identified, five on Mission Creek, four on Post Creek, one on Crow Creek, and five on the Little Bitterroot River. Detailed study site descriptions can be found in Volumes II and III of this report.

DISCUSSION

South Bay of Flathead Lake

South Bay, the southern most lobe of Flathead Lake, represents approximately eleven percent of the total lake surface area. South Bay is also the most extensive area of shallow water in Flathead Lake, and therefore, most effected by changes in lake levels.

Physical Habitat

Water quality data collected in South Bay (Figure 3) during the study indicated little annual variation for all paramenters with the exception of water temperature. Dissolved oxygen, pH and conductivity readings were similar in 1984, 1985 and 1986 and probably do not influence habitat utilization patterns for target species. Although pre-dawn dissolved oxygen levels below 5 mg/l occurred near some inshore areas of East Bay (February 1985), these readings were ananalous and could be avoided behaviorally by resident fish.

In contrast, water temperature was sufficiently variable by month and evaluation area to be a potentially important factor influencing fish distribution in South Bay. Seasonal trends in species composition generally followed annual temperature cycles (i.e. cold water species abundance increasing in fall) and support this contention. Temperatures within South Bay in May were observed to drop as rmch as 5°C in five minutes near the narrows, a reflection of upwelling at that site, and may vary as much as 4.5° C between evaluation areas in June and November. Yellow perch and rainbow trout have both been reported to prefer temperatures within 1.4OC of an acclimtion temperature (15OC) (Cherry et al. 1977) and would likely respond to the thermal gradients observed in South Bay.

Vegetative and structural cover are relatively limited in South Bay, a condition which could contribute to lower recruitment for some fish species. Our data show that the study area contained 0.04% structural and 5.4% vegetative cover respectively in June at full pool. Both figures are less than 1.0% at mininum pool. Structural complexity mediates the ecological inter-actions between littoral zone fish and their prey, and can affect local productivity and growth in fish (Crowder and Cooper 1979, Prince and Maughan 1979, Wege and Anderson 1979). Structural complexity is thought to alter the outcome of predator-prey interactions (Glass 1971, Smith 1972, Murdoch and Oaten 1975), and predation is suggested as an important factor in mediating the effects of competition among prey (Hall et al. 1970, Neil1 1975). These factors may explain the observed failure of largemouth bass to successfully survive to recruitment in any great numbers. Relatively overwhelming numbers of yellow perch in South Bay may prey upn larval bass to the point of suppressing the bass population. They may also outcompete young bass for zooplankton. Most likely, all the above are sources of early life mortality among Flathead Lake bass which create a synergistic effect.

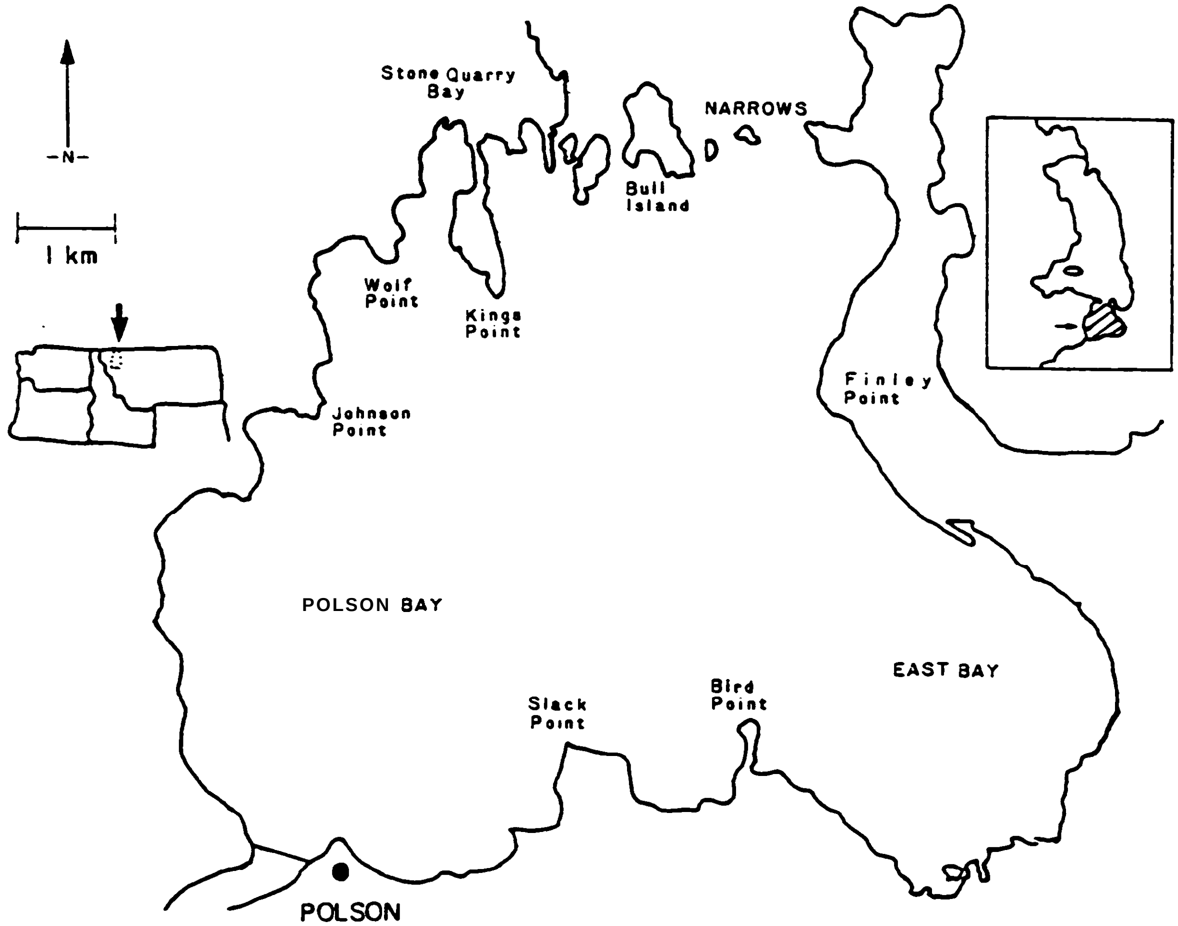

Figure 3. Location and important features of South Bay, Flathead Lake, Montana.

Structural complexity may also be important to overwinter survival of young perch in Flathead Lake. Winter conditions, including ice cover and fall drawdown, seasonally eliminate the vegetative portion of most rooted macrophytes in South Bay. This results in substantial loss of what little structural cover exists, and deprives the perch population of habitat which has been exploited all sumner. ware (1973) identified prey exposure as a major component of the total risk prey incure. The loss of cover and draw-down concentrates and probably exposes the perch to greater predation, including cannibalism, than would occur if structural complexity were greater.

Yellow Perch

The growing importance of the yellow perch fishery is illustrated by comparison of past creel surveys and two conducted during the study. Robbins and Worland (1966) reported harvest rates for Flathead Lake fisheries and estimated yellow perch second only to kokanee salmon in numbers harvested, comprising 17% of all fish harvested lake wide between May 1962 and April 1963. In an 1982 lake wide census (Graham and Fredenberg 1983) a harvest composition of 6% yellow perch was reported. When only shore and ice anglers were considered in the latter survey, the percentage of yellow perch increased to 33%. because of differences in survey methodologies and objectives between reports, comparisons should be viewed cautiously.

Study creel surveys were conducted in 1985 (ice fishery only) and in 1986 (ice and spring fishery). In 1985 anglers were not surveyed during approximately the first two weeks of the ice fishery. During that time, anecdotal information suggested that catch rates and angler pressure were higher than later in the season. Therefore the total harvest estimate of 17,319 fish for 1985 is conservative. A sinple expansion assuming angler effort and creel rate values during these two weeks to be equal to those for the reminder of the survey period, results in a total harvest estimate for the ice fishery of 20,388 fish in 1985. An estimated 32,465 fish were harvested during the 1986 ice fishery. The 1985 and 1986 ice fishery harvest estimates are two and three times respectively the harvest estimated by Graham and Fredenberg in 1983.

The average size of yellow perch creeled in the 1985 and 1986 East Bay ice fishery (227.5nun) was slightly larger than the average for yellow perch creeled lakewide (210 mm) during 1962 and 1963 (Robbins and Worland 1966)r and may reflect selectivity by either anglers or creel clerks, or the availability of suitable perch habitat in East Bay.

Graham and Fredenberg (1983) reported a yellow perch harvest from the 1982 ice fishery (South, Skidoo, and Somers Bays) that was 99% of that total catch, with a creel rate of 1.20 fish/angler hour. This contrasts sharply with our 1985 and 1986 data. Ice fishery harvest estimates were approximately 37% and 43% of the total catch in 1985 and 1986, respectively, with creel rates of 3.18 and 3.94 fish/angler hour, respectively. Differences between survey results may stem from differences in methodologies and monitoring effort, increased fishing pressure and a possible change in the large perch population with a strong skew toward smaller fish.

The spring fishery, which occurs primarily in April on groups of spawning perch, was monitored in 1986. This fishery accounted for an additional estimated harvest of 6,029 perch bringing the total perch harvest during the 1986 surveys to 38,494 fish. This represents only those fish harvested from East Bay. An additional 2,000 to 5,000 fish are estimated to be harvested annually outside of East Bay bringing the total harvest of yellow perch in Flathead Lake to approximately 41,500 fish in 1986. This approaches the estimated harvest of kokanee in 1986 of approximately 50,000 fish (W. Beattie, MDFWP, per. com.).

We could identify no negative impacts to yellow perch associated with the present operations of Kerr Dam. The timing of yellow perch spawning in Flathead Lake corresponds with maximun draw-down under present hydroelectric operations and refill provides increased habitat for the population to expand into just as fry are hatched. As a result yellow perch do not experience the early life history losses observed in Flathead Lake Kokanee under the same operational pattern (Beattie and Clarxey 1987). Winter draw-down exposes yellow perch of all ages to potentially greater predation due to a lack of cover, particularly young of the year perch which may be heavily cannibalized. This Fattern may actually be of benefit to the perch population as a whole by reducing recruitment, providing a ready forage base for larger perch in winter when aquatic insects may not be readily available, and reducing stunting, a common problem in Managed yellow perch populations.

Lower` Flathead River

The lower Flathead River drains 386,205 hectares, and is a low gradient river. Based on general valley characteristics, gradient, and channel morphology, the lower Flathead was divided into four distinct river reaches. Reach breaks, representative study sections and important backwater areas sampled throughout this study are shown in Figure 4.

Largemouth Bass

The date of introduction of largemouth bass in the lower Flathead River could not be determined. Largemouth bass are primarily backwater residents of the lower Flathead and were collected from all permanent backwater areas in river reaches III and IV. They were rarely found in main channel areas. The greatest concentration of bass were found in the largest backwater areas.

Based on the reproductive condition of bass captured throughout the study, spawning begins in the later half of May and continues through June. Brown (1971) reported eggs and fry cannot tolerate temperatures below 10°C. Water temperatures in the lower Flathead usually warm to 10°C and above by the later part of April.

In the Flathead River, young-of-the-year largemouth bass grow to approximately 70 mm by the end of their first year. By their second year they have reached 120 mm, and by age 4, the usual age of maturity, they have at least doubled in length to 240 mm. Bass from the lower Flathead showed a faster rate of growth than those reported by Brown (1971) for Montana largemouths, but grew at a somewhat slower rate

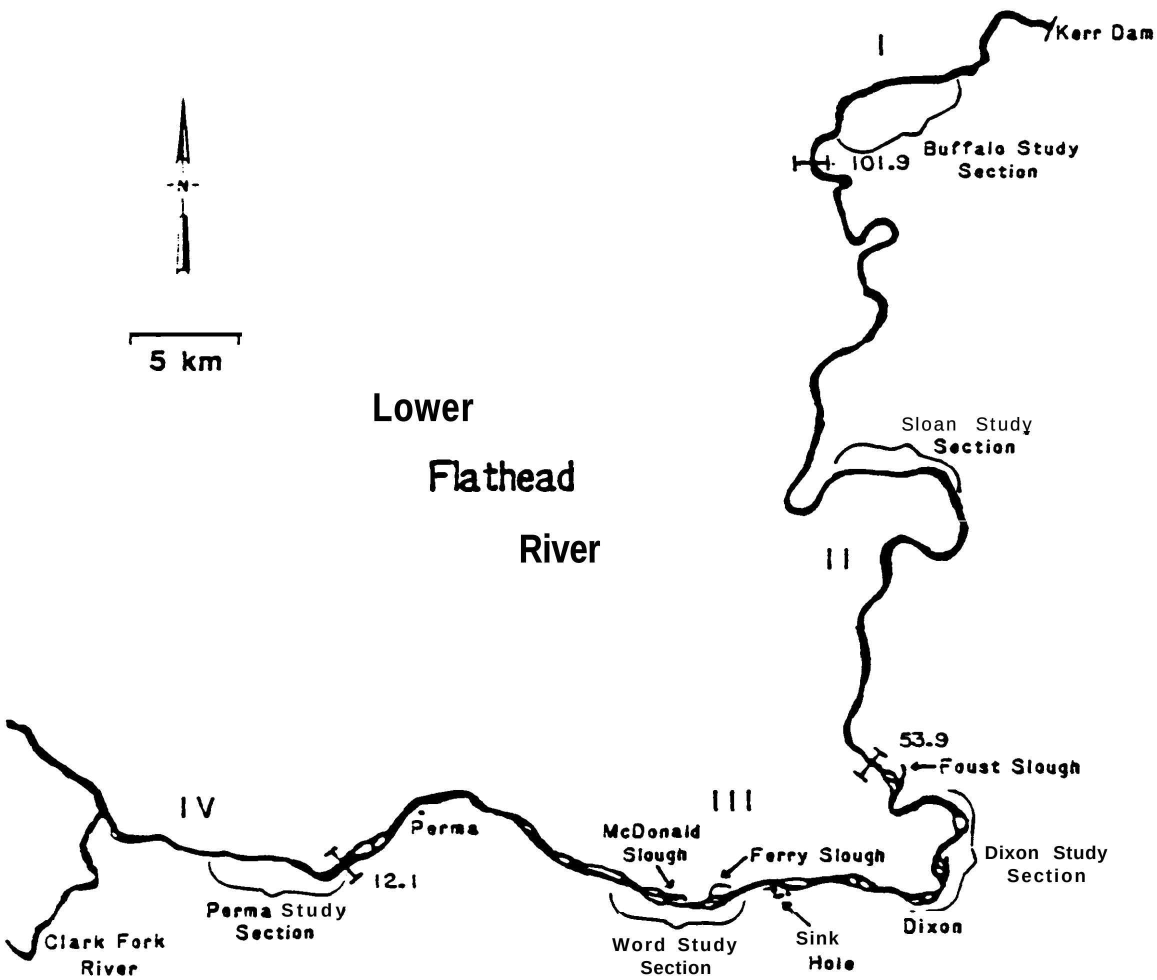

Figure 4. Beach breaks, permanent study sections and important backwater areas of the lower Flathead River.

through age 4 than the rates reported by Scott and Crossman (1973) for bass from the Great Lakes area.

The oldest Flathead River largemouth bass captured was 10 years old (based on scale analysis) and 527 mm long, considerably larger than the average length for similar aged bass reported by the above authors. The average length of all bass captured throughout this study was 307 mm; fish age 4 and older dominated (N = 188).

Angler exploitation of largemouth bass appears minimal, with only two tags returned (1%) in three years. During the summer of 1983, river anglers caught bass at an average rate of 1 fish every 2.3 hours (DosSantos and Cross 1984). Largemouth bass were found in only a few areas in adequate numbers to support heavy fishing pressure. Low exploitation may be due to fishermen not knowing where to fish for bass.

Salmonids

The relative abundance and population structure of trout species studied in the Lower Flathead River from 1983 through 1986 reflected a lack of successful recruitment. Cutthroat and bull trout, although incidentally collected throughout the length of the river, are rare. Forty cutthroat and 17 bull trout were captured and tagged during 4 years of study. The most probable origins of these cutthroat and bull trout are the upper reaches of the river's tributaries, upstream migration from the Clark Fork River, or successful passage through or over Kerr Dam.

Based on results from application of the Instream Flow Incremental Methodology (IFIM), weighted available habitat (WA) in the lower Flathead River for cutthroat trout is greatest in the braided channel section of the river than in the single channel portion. The highest electrofishing catch-per-unit-effort (fish/hour = CPUE) also occurred in this reach. Based on our IFIM analysis, significant losses in habitat (>50%) occur for all cutthroat trout life stages at discharges greater than 6,000 cfs. Available spawning habitat for cutthroat trout is extraly limited in the main river regardless of discharge.

Rainbow trout were found along the entire length of the river, but were most abundant in river reach III (Figure 4). Population estimates for this reach have ranged from 6 to 11 fish/km. The age class structure of lower Flathead River rainbow trout reflected serious recruitment problerrcs relative to rainbow trout populations studied in other lMontana rivers such as the Kootenai (May and Huston 1983) and the Missouri (Berg 1983). Electrofishing catches of rainbow trout in the Flathead are dominated by age 2 and 3 fish; age 1 fish comprise only 1.6% of the catch. In the Kootenai River, using similar sampling methods, age 1 rainbow trout comprise 77.6% of the population (May and Huston 1983). While the sample size of rainbow trout from the lower Flathead was small (N = 183) the lack of age 1 fish was readily apparent (Darling et al. 1984).

Based on main river IFIM analysis WIJA for adult rainbow trout in the braided channel is twice that in the single channel section of the main river. Catch rates and population estimates support this analysis. IFIM analysis also points to limited suitable habitat for the juvenile, fry and spawning life stages of rainbow trout throughout the river.

Brown trout were found along the entire length of the river, but were most abundant in the upper reach. Population estimates for this reach averaged 16 fish/km. On the upper Missouri River, the lowest brown trout estimate was 74 fish/km (Berg 1983). As with rainbow trout, few age 1 brown trout were caught from the river, comprising less than 3% of the total catch (N = 277).

The observed structure of the brown trout population in the lower river suggest similar limiting factors which affect both rainbow and brown trout recruitment. Few age 3 or older rainbow and brown trout were captured in the lower reaches of two known spawning streams, Mission Creek and the Jocko River, but predominated in main river samples. In contrast, age 1 and 2 rainbow and brown trout dominated samples in the tributaries, but were rarely captured within the main river. In the Buffalo study section, brown trout averaged 292 mm (age 3) during fall sampling 1983 through 1986, but averaged 425 mm (age 4) during spring sampling 1984 (Figure 4). The shift to larger brown trout in the main river during spring sampling may reflect the return of adults from tributary spawning. Age class differences between river and tributary rainbow and brown trout suggest that recruitment to main river stocks is presently supported by tributary spawning.

Few trout redds have been found in the main river, and then only at its confluence with the Clark Fork River. Although areas appearing suitable for spawning exist throughout the river, they are apparently not selected by spawning salmonids in the spring or fall. However, in many large western rivers, the percentage of adult trout spawning occuring in the mainstem may be insignificant compared with the number spawning in tributaries. In the Kootenai River it is estimated that less than five percent of the total rainbow trout spawning , based on redd counts, occurs in the mainstem (Bruce May, MDFWP, personal communication) . This appears to be the case for spawning trout in the lower Flathead.

Limited gravel sampling was conducted on the main river during 1985. Eighteen samples were collected from approximately 654 hectares of potentially suitable spawning gravel (Darling et al. 1984) . Comparing our results with those of Idaho laboratory studies of sediment and embryo survival conducted by Irving and Bjorn (1984), projected rainbow trout embroy survival in the main Flathead River at 423 relative to the 0.85 and 9.5 mm substrate fractions. Gravel showing the highest predicted embryo survival was from the Weed study section (Figure 4). This area also showed the highest density (fish/km) of rainbow trout. Survival rates reported by the study for lower Flathead trout, and based on the above comparisons, should be viewed cautiously; additional work is needed to adequately evaluate the problem.

Detailed evaluations of substrate composition and instream cover throughout the river, conducted in conjunction with IFIM modeling, showed that structural diversity is limited in the lower Flathead River. In the single channel section of the river, larger substrates and an occasional boulder provide the only instream cover. In the lower reaches of the river, where substrates are primarily gravel, the river channel contour has little relief, affording essentially no instream cover. The recruitment of large woody debris is very limited. The structural hcmogeneity of the lower river channel results in limited feeding and resting stations for salmonids, as well as limited conspecific visual isolation.

Hydropower Effects

Seasonal and daily variability in discharge from Kerr Dam are highest in the spring and fall (Figure 2), and may have serious impacts upon spawning success of lower Flathead River trout. Constantly changing water depths and velocities over suitable spawning substrates may confuse adult trout seeking spawning sites in the main river, and cause behavioral changes such as spawning late or not spawning at all. Hamilton and Buell (1976) concluded that the abrupt changes associated with fluctuating flows due to hydra-peaking operations caused serious recruitment problem for salmonids in ` Campbell River system, British Columbia.

IFIM analysis conducted on the Flathead River supports the above conclusion. The narrow ranges of acceptable discharges to maximize habitat for spawning and the fry life stages of rainbow and cutthroat trout in the lower Flathead River are seldom met for any extended period because of Kerr operations.

Daily fluctuations in river discharge, which in the lower Flathead River may be more than an order of magnitude, preclude the establishment of rich, slow-moving areas usually favored by young riverine fishes (Holden 1979). Chapman and Bjorn (1969) reported habitat preferences of ot salmnids to be areas shallower and slower than those selected by older fish. Young-of-the-year salmnids were reported to prefer to over-winter in shallow water with low velocity (Cunjak and Power 1986). This preference for shallow water and low velocity is apparently a function of energetic considerations related to body size (Smith and Li 1983). Microhabitat sites of shallow water and low velocities utilized by young-of-the-year trout are the most affected habitats because of the frequent changes in river discharge due to Kerr's operations.

Stock assessment in 1983 and 1984 show& population levels of mountain whitefish in the lower Flathead River to be comparable to other western Montana rivers of similar size (Darling et al. 1984). Whitefish spawning requirements (mter depth, velocity and substrate canposition) are not as specific as those for trout because they are broadcast spawners (Brown 1971 Bovee 1978). The variability of discharges from Kerr, highest in spring and fall, has not affected recruitment of mountain whitefish in the lower Flathead.

The question of coqetitive interactions between mountain whitefish and other salmonids, namely rainbow trout, has troubled many western fisheries managers for nearly half a century. Early studies (McHugh 1940, Sigler 1951 and Laakso 1951) concluded that mountain whitefish, with a higher fecundity than trout (Scott and Crossman 1973), were serious competitors for food and space with rainbow trout. Recent investigations (Pontius and Parker 1973, Thompson 1974, Kiefling 1978 and DosSantos 1985), however, have questioned this theory of competition between these two salmonids.

One effect of river regulation is a shift in the benthic insect community (Baxter 1977, Stanford and Ward 1979), with Chironanidae being one of several insect families that flourish in regulated rivers (&pert-Perry and Huston 1983). The potential for competition for a specific food item (Chironanidae) exists between small rainbow trout and small whitefish (<200 mm) and habitats occupied by these smaller fish are similar (DosSantos and Huston 1983, and DosSantos 1985). Odum

(1971) defines interspecific competition as "any interaction between two or more species populations which adversely affects their growth and survival". This definition may apply to present-day rainbow trout and whitefish populations within the lower Flathead River.

Recently several authors have concluded that mountain whitefish and trout in other western rivers do not actively compete for food (Kiefling 1978 and DosSantos 1985). In these studies, trout populations were several hundred fish per kilometer. In the lower Flathead, due to the ratio (approxirrately 325~1) of whitefish to trout it may not be a question of interspecific competition for food, but suppression of trout by whitefish through competition for micro-habitats. Additional predation by whitefish may also be a problem. Ricker (1941) demonstrated that mountain whitefish will eat young fish; one specimen he examined contained ten small sockeye in its stanach. This potential has not been satisfactorally investigated.

Zoobenthos studies in the lower Flathead River clearly demonstrated that on either side of the wetted river channel there exists a varial zone in which zoobenthic production is severely limitd due to daily dewatering. Similar conditions have been described for other rivers subjected to variations in discharge due to hydroelectric operations (Gislason 1985). Zoobenthic production in the permanently wetted section of the lower Flathead River channel was founded to be comparable with that of the Kootenai River below Libby Dam (Hauer and Potter 1986, Appert-Perry and Huston 1983). The survival of young trout dependent, due to energetics and swimming ability, on microhabitats and food located in the varial zoner is jeopardized by daily fluctuations. Young fish are suseptible to stranding (Thormson 1970, Phinney 1974, Olson and Metzgar 1987) due to daily fluctuations in discharge, and available food in the form of zoobenthos is severely restricted. Adult fish, physically capable of making full utilization of the main channel and thus able to access and exploit a food source unavailable to younger fish, were found to be in excellent condition despite fluctuations in discharge.

We believe that the constantly recurring impacts of Kerr Dam flow fluctuations on fish behavior (such as spawning)r egg survival, juvenile habitat, over-wintering survival, zoobenthos abundance and distribution. Another possibility is that interactions between an overwhelming whitefish population and a severely depleted trout population restrict the size of the annual standing crop of young trout in the lower Flathead River. Survival in the early life stages of many fish species often determines adult population size, and these life stages in many riverine fishes require stable near-zero velocities (Larimore 1975, Ottaway and Clark 1981, Ottaway and Forrest 1983). Orth (1987) has suggested fish densities may be strongly related to habitat conditions during the critical early life stages. In the lower Flathead River the greatest daily fluctuaticns in river discharge due to Kerr operations occur during the early life histories of all important game fish creating the hostile environment we have termed the varial zone.

Northern Pike

Northern pike were found throughout the length of the lower Flathead River, occupying lentic habitats. Within the single channel section of the river, reaches I and II, northern pike were found alcng deep, slow moving river bends, shoreline eddies, and slackwater shoreline areas. The upper reaches of the river provide limited habitat for pike as reflected in CPUE data.

In river reach III, gradient and water velocities decrease, permanently wetted backwaters are cconmon, and pike abundance, based on intensive sampling (CPUE)I was twice that of reaches I or II. The corrbination of both riverine and lentic habitats supported the largest northern pike concentrations within the lower Flathead. cheney (1972), in his investigations of northern pike in the Tanana River, Alaska, found the blend between lotic and lentic habitats most preferred by pike.

Reach IV of the lower Flathead had the lowest gradient and greatest abundance of main channel macrophytes of any river reach. however, pike abundance in this reach was comparable to reaches I and II. Deep water holding habitat, preferred by pike during the daylight hours, and as overwintering sites were not found in reach IV. Increased macrophyte cover may not be as important as deep water holding habitat in providing optimum riverine habitat. Reach IV affords no protective cover from ice scour during winter thaws and spring break up, and may explain why pike populations are lower in reach IV than observed in reach III.

Radio tagged adult pike in the Flathead River preferred water depths in excess of 2 m and water velocities not exceeding 0.2 m/second (0.6 ft/second, mean = 0.45 ft/second). Inskip (1982) reported that optimal water velocities for riverine pike should not exceed 0.06 m/second (0.2 ft/second). Limitations in metering gear did not allow for an accurate average water column velocity or focal point measurement in depths in excess of 2 meters. Measured velocities within deep water areas were probably higher than those actually experienced by the fish, assuming laminar flow at these sites. Habitats utilized by northern pike in the lower Flathead River were usually totally vegetated, providing excellent cover for mush predators. Chapman and Mackey (1984) observed pike 81% of the time in totally vegetated areas.

At night, lower river pike were found in extremely shallow water near the river bank. They may use the shallow bench areas as resting areas with darkness protecting then from potential avian predation. Pike were rarely observed in these locations during daylight hours. These sites are severly impacted by Kerr operations.

In the lower Flathead, male northern pike wre sexually ripe by the first week of April and females were sexually ripe by 1 May. Pike began movement to spawning grounds about the time they became ripe. Radio tagged males showed maximum upstream movements of 17 km in 27 days and maximum downstream movements of 45 km in 15 days during the spawning season.

Based on radio telemetry data, male pike spent up to three months in and around spawning grounds, leaving during the late June or mid-July. Females spent approximately six weeks at spawning areas, usually centered around June. Peak spawning occured from late May through the first half of June, with the center of spawning activity occurring between the Pike Hole (RK 48.9) and McDonald Slough (RK 29.0). Limited spawning sites existed both up and downstream from this 20 km river area, and some spawning may have occurred in these isolated areas. Radio telemetry data dmnstrated that pike moved up to 30 km both upstream and downstream, to reach this river area and passed other isolated areas where spawning fish were also found.

A total of 299 mature pike were captured either entering spawning areas or in staging areas adjacent to them. The male to female ratio was 2.3:1. Priegal and Krohn (1975) reported a healthy sex ratio of 2:l for some pike populations in Wisconsin. Disproportionate angler harvest of larger pike (almost all fenales) within the lower Flathead may explain the observed higher number of males within the spawning population. Harrison and Hadley (1983), studying the Niagra River in New York, reported a sex ratio of 4:l. They postulated that a bias toward males was due to the longer time during which males are sexable by the extrusion method. We experienced similar problems and this may explain the unusually high sex ratio (5:l) observed in 1985.

Spawning occurred during daylight hours, and was observed in two backwater areas. Spawning groups, consisting of a ferr&e plus one or two males, moved in short rapid bursts then were stationary, presumably at rest. The fertilized eggs adhere to vegetation, and at water temperatures above 10°C, hatch in 12 days or less. After hatching, fry adhere to vegetation and remain attached from 10 to 24 days (Inskip 1982). It is this approximately 30 day period, from egg laying to mobile fry movement, when northern pike year class strength can be roost seriously influenced by Kerr Dam operations. Water level fluctuations at spawning sites can aggravate suspended sediments and contribute to egg suffocation. Hassler (1970) attributed 97% egg mortality to silt deposition caused by fluctuating water levels in two main-stem Missouri River impoundments. Attached eggs and fry that successfully hatch and attach to vegetation, are subject to dessication due to dewtering as the river discharge varies. A change of only 3 cm in water surface elevations can change inflow to outflow in some spawning areas (DosSantos et al. 1983).

Average size of captured Flathead River male and fernale pike spawners was 688 and 699 mm, respectively. These lengths correspond to age 4 fish for the lower Flathead, the usual age of maturity for northern pike (Scott and Crossman 1973). Spawning males ranged in size from 428 to 975 nan (Age 2 and older& while female ranged from 540 to 996 nun (Age 3 and older). Because of the highly aggressive nature observed in spawning males (i.e., lacerated fins and bodies), young males may not have contributed significantly to spawning success. Growth of male and female northern pike in the Flathead River was similar through age 3 (Darling et al. 1984). Fish older than age 4 show differential growth between the sexes, with females growing faster. Similar observations have been noted in other studies (Anderson and Weithman 1978, Komyshwaya and Tsepkin 1973, and Philips 1980). Flathead River young-of-the-year pike grew to approximately 250 mm by the end of their first year. My their third year they doubled their length. By their fifth year, male northern pike may reach 675 mm TL and f&e pike 965 n-m T'L. Seventy percent of all northern pike handled were age 3 or younger.

Northern pike are the most highly sought after species of fish by anglers in the lower Flathead River (DosSantos and Cross 1984). The present exploitation rate, 12% estimated from tag returns, is low compared to exploitation rates of 31% reported by Williams and Jacob (1971) and over 50% reported by Beyerle and Willis (1972).

Tributaries

This portion of the study was confined to the main stems of the five major tributaries to the lower Flathead River: the Little Bitterroot River, Crow and Post/Mission Creeks, and the Jocko River (Figure 5). The Jocko River, Post/Mission Creek, and Crow Creek, are the major spawning grounds for trout from the main river. Data collected at weirs on the Jocko River and Mission Creek, redd surveys in the main river and tributaries, and comparisons with data from other drainages (e.g. Kootenai River) support the important role the tributaries play in the life history of Flathead River trout.

Fish Migration

Trout moving from the main Flathead River into the Jocko River apparently move no farther upstream than Reach 5 (km 42, Figure 5). Trout tagged in the lower Flathead River were recovered as far up the Jocko River as km 38, 5 km above the town of Arlee. Immediately above km 38 a section of the river is dewatered seasonally by irrigation diversions. There is also a major unscreened irrigation diversion (Jocko K Canal) which acts as a barrier at km 42. In Reaches 6 and 7, above the diversion, resident fish populations differ from those in the lower five reaches in species composition, mean length, and total number of fish, further supporting the contention that the K Canal diversion is a barrier to fish movement.

Although no barrier to fish migration is apparent in Mission Creek, changes in species conposition (eastern brook trout appear and brown trout are not found) indicate that fish populations above its confluence with Post Creek change from migratory to resident. Water in Post Creek is turbid due to irrigation returns. This turbidity change my discourage upstream movement above km 3 in Post Creek. Movement of trout from the lower Flathead up Crow Creek is stopped at Lower Crow Dam (km 5.6).

No redds were found in the main stem of the lower Flathead River, other than at its confluence with the Clark Fork River, and recruitment of trout to the lower river depends heavily upon successful spawning within a few tributaries. Of these tributaries, only the Jocko River has stable flows in most reaches (unlike the extreme and rapid fluctuations in lower Crow Creek) and good water quality year-round (unlike the turbid lower ends of Pest and Mission Creeks).

Small but distinct spawning runs of main river rainbow and brown trout moving into the Jocko River were monitored at the Jocko weir. The Jocko River between the towns of Ravalli (km 14) and Arlee (km 31) is particularly critical to spawning trout, especially brown trout. Redd counts conducted during fall 1984-86 indicate that the majority of brown trout spawning in the lower Flathead River system occurs in this segment, even after accounting for multiple redd-building and spawning by resident trout.

A cursory survey of spawning gravels in the Jocko River indicated that important trout spawning areas have been degraded by sedimentation. Irrigation returns and poor riparian management are the most apprent sources of this sediment. Predicted trout embryo survival averaged 34% within the critical area of the Jocko River between Ravalli

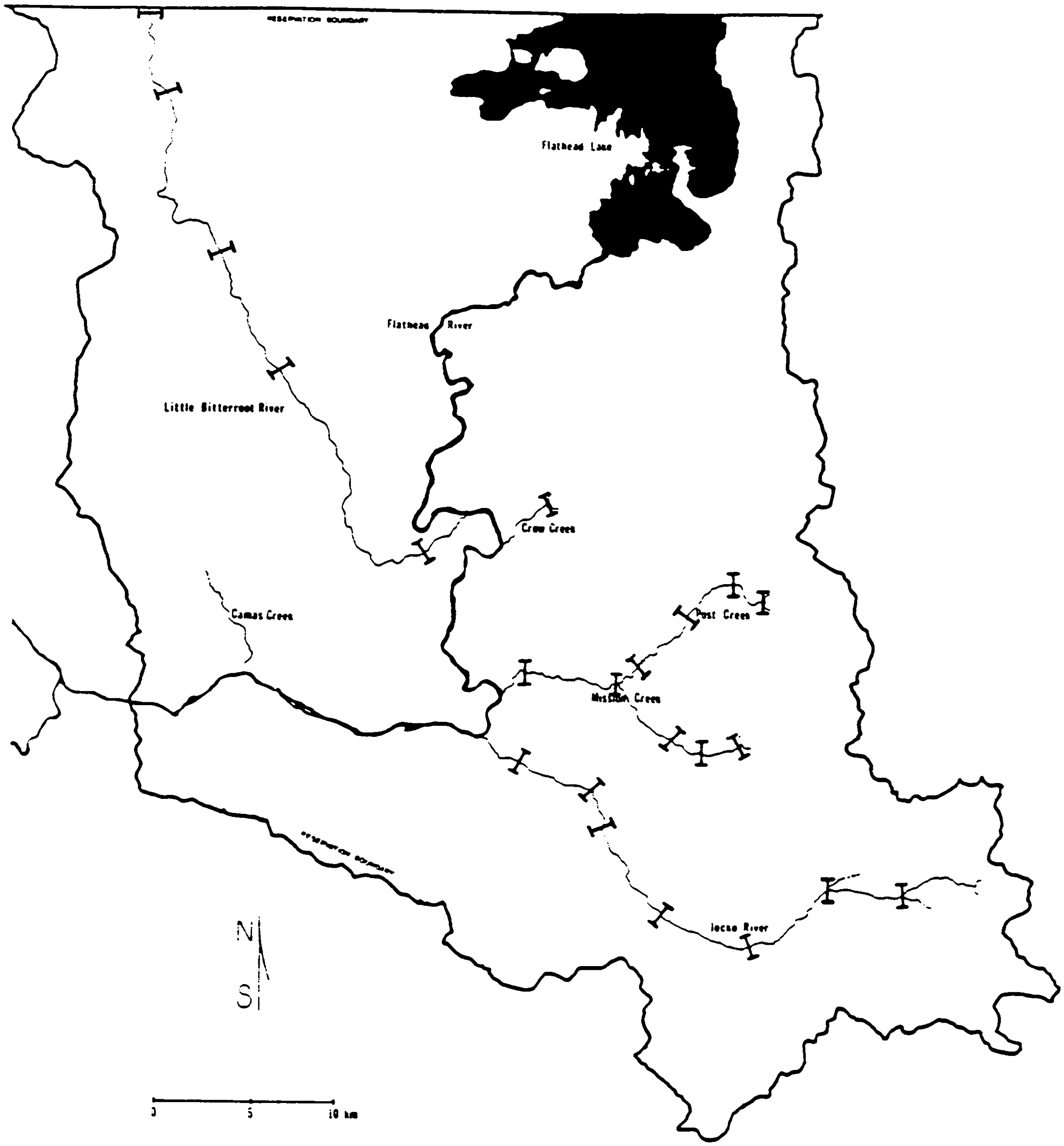

Figure 5. Reach boundaries established on the five major tributaries to the lower Flathead River.

and Arlee based on substrate fractions smaller than 0.85 and 9.5 mm, assuming brown trout are at least as sensitive to substrate fines as rainbow trout. No laboratory studies have been conducted on brown trout survival to emergence.

Very few age 2 and older rainbow and brown trout were found in the lower five reaches of the Jocko River during fish population sampling. Out-migration of older trout to the lower Flathead River is one possible explanation; however, fishing pressure may contribute significantly. Wesche et al. (1987) concluded that much of the variation in brown trout standing crop may be due to angler harvest. In a mail-out census of anglers conducted periodically from 1965 through 1986 by the MDFWP, fishing pressure averaged 4,300 (SE+2499) angler-days per year for the Jocko River (memo dated 20 April 1987 from L. Hanzel, MDFWP, Kalispell, Montana) , and Tribal members traditionally have been allowed unlimited harvest of fish on the Flathead Reservation. In addition, large unscreened diversions at the Jocko J, S and K canals are suspected of being responsible for major recruitment losses.

Of 528 rainbow trout measured during a creel survey conducted from April to September 1984 on the Reservation, 98% were 200 mm or longer (DosSantos and Cross 1984). The 12 brown trout creeled averaged 312 mm in length. In contrast, only 15% of the rainbow trout captured during stock assessment electrofishing were longer than 200 mm; 13% of the brown trout were longer than 200 mm.

Concerned by the lack of fish greater than 200 mm in the Jocko River the Tribal Council implemented a catch and release policy in 1987 and will monitor the results in terms of changes in age class structure over the next six years. Adoption of similar regulation on sections of Rock Creek near Missoula resulted in a 475% increase in rainbow trout 279 to 353 mm long (Peters 1983). Dramatic increase in numbers of larger fish were also observed in Kelly Creek and the St. Joe River in Idaho in response to special regulations (Johnson 1977).

More than double the number of rainbow trout spawners were trapped at the Mission Creek weir than Jocko River weir between February 1984 and May 1986. Predictions of rainbow trout embryo survival based on gravel samples from Mission and Post Creeks was less than that predicted for the Jocko River. This data is at odds with the observed run sizes. Rainbow trout recruited to the lower Flathead River due to periodic flooding of a small rainbow trout hatchery on Post Creek (km 7) is the probable source of the larger spawning run.

Length-frequency histograms of trout from the Mission/Post Creek drainage do not reflect the same dramatic decline in fish abundance from age 1 to age 2 seen in the Jocko River. Mission Creek below its confluence with Post Creek receives less fishing pressure than the Jocko River (L. Hanzel, MDEWP, per. cam.), and much of this reach runs through the National Bison Range and is closed to fishing. The remainder of the stream is turbid during fishing season due to irrigation returns, reducing its desirability to many fishermen, and access is generally limited in Post and Mission Creeks above their confluence. Trout in the upper reaches of Post and Mission Creeks are smaller at maturity than those in the more popular Jocko River.

Crow Creek

Crow Creek provided an interesting contradiction of results. More than 40 adult rainbow trout were captured during each electrofishing survey of the 5.6 km below Lower Crow Reservoir, yet redd counts never exceeded six. Up to 49% of the trout tagged in Crow Creek were recaptured near their tagging site, yet their large size and the recapture of one rainbow at Mission Creek weir indicate the population is probably not resident in the stream. The majority of Crow Creek trout were found within 0.8 km of the dam (i.e. above the unscreened Moiese A Canal diversion), where armored cobble substrate predaninates, and available spawning gravel can be **accessed** only at high flows.

Crow Creek may serve as a thermal refuge from water temperature extremes in the lower Flathead River. The Jocko River, Mission and Crow Creeks are all cooler than the main river during the summer. In addition, Crow Creek is warmer (4'C) than the lower river in the winter, and warmest near the dam, where hypolirmetic water is released from Crow Dam. Rainbow trout have been shown to move in response to as little as l°C temperature change under laboratory conditions (Cherry et al. 1975), and Cunjak and Power (1986) have speculated on the importance of "thermal refugia" to over-wintering fish. Spawners attracted into Crow Creek may have built few redds because flow releases from the dam have been extrenely erratic historically and an armored substrate may prevent successful redd construction.

Little Bitterroot River

Northern pike finding adequate flows to enter the Little Bitterroot River encountered other obstacles to movement. Rock outcrops, beaver dams, and flow deflectors for irrigation pumps obstructed passage in the lower 6 km of the Little Bitterroot, and water was withdrawn throughout the next 70 km dewatering sections of the river. High turbidity (30 to 40 NTU's) may have also discouraged movement in the lower 44 km of this river. Most of this turbidity was introduced by Sullivan Creek (km 56) and Hot Springs Creek (km 44). Nonpoint sources such as runoff and streambank sloughing in extensive areas with poor riparian managmt maintained the high turbidity levels to the river mouth.

Although some interchange with the main river does occur, the Little Bitterroot supports primarily a resident northern pike population. In the lower Flathead River, pike reached an average length of around 370 mm at the end of their second year compared to 300 mm for Little Bitterroot pike. Main river pike longer than 1000 mm have been captured, while pike longer than 500 mm were rare in the Little Bitterroot River,

Northern pike spawning in the Little Bitterroot River appeara to be concentrated in the 32 km between Hot Springs Creek (km 44) and the Camas A Canal diversion (km 76). The diversion is an absolute barrier to all fish, while Hot Springs Creek changed habitat suitability by introducing very turbid water, which hampered the growth of aquatic vegetation critical to successful pike spawning. The dramtic decline in numbers of spawners captured at Lonepine marsh (km 60) indicated that either spawning sites shifted or weaker year classes were spwning in

1984 and 1985. Events such as early runoff during January 1984 and flooding during February 1985 could have influenced shifts in spawning pike concentrationsI or actual dislocation of adults.

Instream Habitat

The evaluation of instream tributary habitat was accomplished by using the Instream Flow Incremental Method. Results clearly showed that optiml habitat (based on WUA output) could be made available for all life stages of brown, rainbow and cutthroat trout. Based on basin characteristics regression equations estimated monthly discharges for Post and Mission Creeks and the Jocko River were adequate to meet IFIM optiLml flows. However, actual discharges in these streams are frequently less than the flows projected to produce optimal fish habitat. Therefore, it much be concluded that the construction and operation of the Flathead Indian Irrigation Project, along with general agricultural practices on the Flathead Reservatin are restricting the true potential of the main river tributary system.

CONCLUSIONS

The results of this study have described the impacts associated with hydroelectric operations in South Bay of Flathead Lake and hydroelectric operations, irrigation project development and operation, and agricultural practices in the lower Flathead River and its triburaties. We believe that these activities, acting in concert, have determined to a great extent the present degraded status of the lower Flathead system aquatic habitat and dependent fish stocks. Even so, it is possible to mitigate many of these impacts and restore a viable fishery.

Study results lead to the following conclusions for South Bay:

1. Yellow perch support an important and growing fishery in South Bay of Flathead Lake.
2. The existing pattern of lake drawdawn and fill for hydroelectric purposes coincidentally corresponds to the biological requirements of yellow perch for spawning and increased habitat upon hatching.
3. Fall drawdown exposes young-of-the-year fish to predation and possibly prevents stunting of the perch population.
4. Recruitment in the existing largemouth bass population of South Bay is probably controlled by an overwhelming yellow perch population which may directly prey upon young bass and/or complete with then for a limited food supply.
5. The presence of northern pike in South Bay could not be docmted.
6. Structural complexity in South Bay is extranely limited at all times of the year. However, this physical deficiency can be enhanced through the use of artificial reefs.

Our results have clearly shown Kerr hydroelectric operations and operational constraints have negatively affected Flathead River trout, producing the lowest abundance of trout for a river of this size in Montana. Northern pike populations and the spawning habitat which support them are also seriously impacted. We suggest the following mechanisms acting independently and in concert have resulted in the existing situation:

1. Present hydroelectric operations result in frequent changes in river discharge of sufficient magnitude to kill fish eggs and young northern pike which are attached to littoral vegetation, and strands fry and juvenile fish. Adult fish are rarely stranded.
2. Frequent changes in river discharge resulting from present operations may modify fish behavior, especially during spawning, by constantly changing habitat variables used by fish to select spawning sites.
3. The present operational regime of Kerr prevents full utilization of the river channel by aquatic insects thus, the varial zone on each side of the channel is largely devoid of aquatic insects even when the channel is fully wetted. This greatly reduces the productive potential at

all higher trophic levels and may especially impact the forage base for juvenile fish associated with the lateral habitats.

4. Present river regulation creates daily and hourly changes in habitat quality and quantity when flows are less than, or exceed habitat tolerances of a species or specific life stages of species.
5. The present operational regime results in monthly average discharges triple the historic mean during winter months. Severe icing conditions I cortbined with flow fluctuations, causes excessive streambank destabilization.
6. Extreme and detrimental fluctuations in river discharge during the spawning period of northern pike, and prior to major aquatic insect emergence periods, such as hydrophychid caddisflies, have been allowed because coordinated operational planning for Flathead Lake recreation and power production failed to incorporate fish and wildlife requirenents in the lower river.

In addition, the construction and operation of the Flathead Indian Irrigation Project (FIIP), along with the general agricultural practices on the Flathead Reservation play a role perhaps equal to Kerr Dam operations in creating the current degraded status of aquatic habitat and fish populations of the lower Flathead ecosystem. We identified the following major in-pacts to the rivers tributary system.

1. Unscreened irrigation diversions intersect all Mjor (and most minor) tributaries. These diversions have the potential of trapping fish of all species and age classes in irrigation canals, thereby reducing recruitment to the tributaries.
2. Frequent, erratic changes in streamflow below irrigation diversions and dams of FIIP create constantly recurring impacts to fish habitat without regard for the seasonal habitat requirements of those affected fish populations. In some cases aquatic habitat has been seasonally eliminated.
3. Inefficient irrigation practices result in irrigation return flaws laden with silt (and possibly herbicides and pesticides) increasing stream turbidity and streambed sedimentation. The negative irqacts of sediments in streams is well documented.
4. The construction of irrigation diversions, canals, and dams on main-river tributaries reduces gravel recruitment, and eliminated access to more than 100 kilometers of spawning and rearing habitat.

ALTERNATIVE MANAGEMENT STRATEGIES

Management strategies for the lower Flathead system were developed in part during informal consultation with the Tribal Council and other agencies, and modified as new data became available. The strategies range from no action, regulations of Kerr discharge to enhance fish habitat, to intensive off-site mitigation if the main river were dedicated to hydroelectric operation. The study recognizes the final selection of appropriate mitigation lies with the Flathead Tribal Council. We also recognize that new management strategies could be generated by combining sane alternatives and that management strategies now under consideration by Montana Power Company may influence the final decision for the appropriate level of mitigation in the Flathead System.

The Lower Flathead System Fisheries Study has identified the existing condition of aquatic habitat and target fish species in the lower Flathead basin. Despite this, the extensive data base needed to accurately identify trends in habitat quality and fish populations in the lower basin is lacking. The challenge to basin resource managers include fisheries protection and rehabilitation, management of diverse aquatic resources for diverse users, habitat protection, and fish stock allocation among user groups. Short term demands of the fishing public and water users could threaten any long-term recovery of the Flathead system fisheries. These strategies are not meant to be an end in themselves (although they could be adopted as such) rather a starting point for discussion. The final strategy must incorporate conflicting public values and generate public support and understanding of the management goals and methods to achieve then. Implementation of any strategy is not recamnended without a extensive long term mnitoring program being sirmltaneously instituted and integrated into a basin wide aquatic resource management plan such as described by Cross (1987).

A short summary of the management alternatives is presented first, followed by a detailed description of each.

SUMMARY OF ALTERNATIVE MITIGATION STRATEGIES

ALTRNATIVE	MITIGATION	DISCRIPTION OF ALTERNATIVE
No Action	No Mitigation	No mitigation for impacts of Kerr Dam. Fish populations are not monitored.
Minimal Action	No Mitigation	No additional mitigation beyond the 3200 cfs minim instream flow already in place. Biannual fisheries monitoring.
In Lieu Payment	Non-operational on-site and/or off-site	The responsible parties make an annual payment to the Tribes for damages caused by Kerr Dam. The money is used for the Tribal Fisheries Program.
Fish & Wildlife Trust Fund	Non-operational on-site and/or off-site	The responsible parties establish a trust fund to pay for damages to fish and wildlife caused by Kerr Dam. The mney is used for fish and wildlife improvements.
Return to Historic Conditions	Operational and non-operational on-site and off-site	Operate Kerr Dam as a run-of-the-river facility. Use a stockingprogram to restore the trout fishery in theFlathead River. restore major spawning tributaries to full production potential.
Monthly Flow Scenarios	Operational# on-site	Change monthly flow regime of Kerr Dam to benefit either spring or fall spawning trout, northern pike, or all game fish combined.
Baseload Operation	Operational, on-site	Kerr Dam operates as a base-load facility and does not provide load frequency control. This would rgllove hourly and daily flow fluctuations.

NO ACTION ALTERNATIVE

Fisheries Management Goals

None

Fisheries Management Techniques

None

Monitoring

None

Impact of Alternative

1. Hydropcwer - no impact to hydroelectric generation is anticipated in the Flathead system.
2. Wildlife - no additional inpacts to wildlife beyond those already existing are expected.
3. Lake level/river flow regime - no changes in fluctuation of lake levels or discharge froxn Kerr are expected.
4. Recreation - no change in recreational boating on Flathe Lake or recreational fishing in Flathead Lake and the lower river are expected.
5. Fisheries - allowable trout hanrest will be zero in the lower Flathead River. Northern pike bag and size limits, 5 fish over 24 inches, will remain in effect.

Note: This alternative is incompatible with the Northwest Power Planning Act because it does not provide reasonable consideration for fish and wildlife.

MINIMAL ACTION ALTERNATIVE

Fisheries Management Goals

1. Maintain existing stocks of trout in the lower Flathead River at present average of 19 fish per kilometer.
2. Maintain existing stocks of northern pike in the lower Flathead River at present levels of 30 fish per kilometer.
3. Maintain existing water quality throughout the lower Flathead River.
4. Maintain a mininum instream flow of 3,200 cfs.

Fisheries Managemnt Techniques

Under this alternative the aquatic conditions which have dictated the present fish population levels and water quality, are expected to continue and no additional management action is required, unless monitoring indicates a reduction in fish populations below levels stated above.

Monitoring

1. Biannual fall population estimates of trout and northern pike will be made using boat electrofishing techniques at all stations established during the study.

Impact of Alternative

1. Hydroelectric Power - no additional impact to hydroelectric generation is anticipated in the Flathead System.
2. Wildlife q no additional inpacts to wildlife beyond those existing are expected.
3. Lake level/river flow regime - no change in the present lake level or lower river flow regimes is expected.
4. Recreation- no change in recreational boating on Flathead Lake or recreational fishing in Flathead Lake and lower river is expected.
5. Fisheries - allowable trout harvest will be zero in the lower Flathead River.

Note: This alternative is incompatible with the Northwest Power Planning Act because it does not provide reasonable consideration for fish and wildlife.

INLIEU PAYMENT ALTERNATIVE

Under this alternative the there would be no changes made in the operation of Kerr Dam. The responsible parties would mane an annual inlieu payment to the Tribes for fish and wildlife damages. This money would be used by the Tribes to restore fish and wildlife both on-site, if feasible and off-site. The 3,200 cfs minimum instream flow would continue to be maintained.

Fisheries Management Goals and Technique

See non-operational mitigation alternatives for an in-depth discussion of the choices available. Monitoring would be contingent upon the management goal selected.

Inpact of Alternative

1. Hydroelectric Power - under this alternative hydroelectric production and flexibility are maximized.
2. Wildlife - negative impacts to island nesting geese and ducks are expected. Tree structures for nesting geese may mitigate goose losses.
3. Lake level/river flow regime - no changes in lake level elevation or lower river flow regime would be implemented for fisheries.
4. Recreation - recreational fishing in Flathead Lake and the lower Flathead River could improve if the inlieu dollars were spent on the Lake or River. Other Reservation waters could also be improved for fishing. Recreational rafting and boating opportunities in the lower river and lake would remain unchanged from current conditions.
5. Fisheries - improvements could be made in the laker lower river, and/or tributaries depending on where mitigation money is spent (see non-operational fisheries alternatives).

FISH AND WILDLIFE TRUST ALTERNATIVE

Responsible parties would establish a trust fund for past, present and future damages to the Tribal fish and wildlife resources due to construction and operation of existing hydroelectric facilities in the Flathead basin. A minimum instream flow of 3,200 cfs would be maintained year-round.

Fisheries Management Goals and Techniques

See non-operational mitigation alternatives for a discussion of the range of choices available. Monitoring would be contingent on the management goal selected.

Inpact of Alternative

1. Hydroelectric Power - under this alternative hydroelectric production and flexibility are maximized.
2. Wildlife - negative inpacts to island nesting geese and ducks could be expected. Tree nest structures could mitigate for ground nesting losses.
3. Lake level/river flow regime - no changes in lake level elevation or lower river flow rqime would be irrplemented for fisheries.
4. Recreation - boating and rafting opportunities would renain unchanged from the current condition.
5. Fisheries - money from the trust fund could be used for fisheries improvement either on-site or off-site (see non-operational alternatives).

PAYMENTS RECIEVED

CAPITAL OUTLAY

REREGULATION DAM

Fisheries Management Goal

1. Rqulate discharge in the Lower Flathead River from the site of the re-regulation dam to the junction with the Clark Fork River to optimize salmonid/pike habitat on a year-round basis.
2. Establish and maintain an average of 200 catchable size trout, all species combined, per kilometer in the Lower Flathead River.
3. Provide for an upward trend in numbers of wild trout over the life of the Kerr Dam license.
4. Provide for an annual harvest of at least 4,000 northern pike (greater than 24 inches) in that reach of the Lower Flathead River from Moiese to Perma.

Fisheries Management Techniques

1. Based on IFIM studies establish a annual flow regime in the Lower Flathead River optimizing salmonid habitat.
2. Stock marked trout at a justifiable, predetermined density in the Lower Flathead River from the re-reg site to Moiese.
3. Allow hanrest of hatchery fish (mrked) only until wild stock have recovered to a harvestable level.

Monitoring

1. Biannually estimate fall standing crop of northern pike greater than 24 inches using electrofishing techniques in that reach of river between Moiese and Perma and evaluate any trend in age and growth of all age classes.
2. Establish an index for forage fish at three sites between Moiese and Perrnar and monitor annually.
3. Biannually make estimates of fall trout populations in the Lower Flathead River using electrofishing gear to determine:
   a. numbers of trout per kilometer
   b. number of marked fish in each year class, and
   c. number of unmarked (wild) fish.
4. Biannually evaluate the results of monitoring and adjust goals or techniques as required.

Impact of Alternative

1. EIydroelectric Power - the flexibility of operating Kerr as a peaking plant would be preserved and additional base-load production could be expected fram the re-reg facility.
2. Wildlife - wildlife habitat for some species, including deer would be irrevocably lost in the pool area behind the re-reg dam. Stable flows below the re-reg facility are expected to improve wildlife habitat along the remaining 60 kilometer of river.

REREGULATION DAM
(continued)

3. Lake Levels - no change would occur in Flathead Lake. A new reservoir would be created of undetermined potential to provide recreation.
4. Recreation - the white water reach between Kerr Dam and Buffalo Rapids would be irrevocably lost. Recreational fishing should be significantly inproved over the existing situation downstream from the re-reg site.
5. Fisheries - the present fisheries below Kerr Dam to Buffalo Rapids would be lost and rapid fluctuation of the forebay would make establishment of a fishery in the forebay difficult. Stable flows in the remining 60 kilometers of lower river should optimize fisheries habitat, and provide an excellent opportunity to establish substantial fisheries for salmonids and pike. Aquatic insect production would be substantially increased under a regime of stable flows.
6. Cultural Resources - many sites would be inundated, eroded and potentially destroyed.

OPERATIONAL AND NON-OPERATIONAL MITIGATION

RETURN TO HISTORIC CONDITIONS ALTERNATIVE

Fisheries Management Goals

1. Re-establish to the greatest extent practicable a viable, naturally reproducing trout fishery in the lower Flathead system.
2. Re-establish a flow regime consistant with the pre-dam hydrograph. Change Kerr Dam operations to a base-load facility.

Fisheries Management Techniques

1. Restore, to the fullest extent practicable, major spawning tributaries to full production potential through protection and enhancement of riparian habitat, meaningful instream flows, and instream habitat in those channelized sections.
2. Initiate a phased stocking program of marked trout, preserving to the extent possible the native gene pool, to re-establish trout densities to 200 fish per kilometer in the lower Flathead River.
3. Institute fishing regulations as needed to assist in restoration efforts.

Monitoring

1. Biannually make estimate of fall trout populations in the lower Flathead River using electrofishing techniques to determine:
    a. numbers of trout per kilometer
    b. number of marked fish in each year class
    c. number of unmarked (wild) fish
2. Conduct biannual creel surveys of trout harvest in the lower Flathead system to estimate growth and survival of wild and hatchery trout and the relative contribution of hatchery stock to the fishery.
3. Annually evaluate the results of monitoring and adjust goals or techniques as required.

Impact of Alternative

1. Hydroelectric Power - this alternative would have a major impact to MPC's ability to regulate its systems frequency control and calls for Kerr to be operated as basically a run-of-the-river plant.
2. Wildlife - a stabilized flow regime would result in significant improvement to fish and wildlife populations and allow conditions to approach those which existed prior to construction. Specifically, significant improvement in ground nesting waterfowl success could be expected.

RETURN TO HISTORIC CONDITIONS ALTERNATIVE (continued)

3. Lake level - this alternative could result in significant changes in summer lake levels, impacting boating on Flathead Lake.
4. Recreation - recreational trout fishing opportunities in river and lake should significantly improve over the existing situation, however changes in lake levels during the Sumner could impact recreational boaters relevant to boat docking and launching.
5. Fisheries - fish populations would benefit by the stablized flow regime and the return to a pre-dam hydrograph.

OPERATIONAL MITIGATION

BASELOAD OPERATION ALTERNATIVE

FISHERIES MANAGEMENT GOALS

1. Provide for an annual harvest of at least 4,000 northern pike (greater than 24 inches) in that reach of the Flathead River from Moiese to Pem.
2. Establish and maintain an average of 200 catchable trout, all species Comnined, per kilometer in the lower Flathead River between Kerr Dam and Moiese.

Fisheries Management Techniques

1. Kerr Dam operates as a base-load facility and does not provide load frequency control, thus stabilizing streamflows.
2. The monthly flow scenario (mean monthly flow) is determined by the dam operators.
3. The 3,200 cfs minimum instream flow is maintained.
4. A stocking program is initiated to restore lower river fisheries. Hatchery plants will be phased out when monitoring indicates that the populations have adequate natural recruitient.
5. Improve spawning habitat in the major tributaries to the greatest possible extent.

Monitoring

1. Biannually estimate fish populations both upstream and downstream of Moiese.
2. Conduct creel census as required.
3. Evaluate stocking program biannually.

Impact of Alternative

1. Hydroelectric Power - Kerr Dam would no longer be used as a peaking or a load control facility.
2. Wildlife - this alternative would benefit wildlife by removing flow fluctuations.
3. Lake Levels - no change from current condition.
4. Recreation - Boating opportunities on the lake will be unchanged. Boating conditions on the lower river will be more predictable. Fishing will improve.
5. Fisheries - Both pike and trout populations will inprove.

MONTHLY FLOW SCENARIO ALTERNATIVES

Impose restrictions on discharges from Kerr Dam to benefit fish. Restrictions would consist of mean monthly flows, flow windows, and ramping rates. There are four different monthly flow scenarios, one for spring spawners, brown trout (fall spawner), northern pike, and all truot and pike carrbined.

Fisheries Management Goals

Either establish and maintain an average of 200 catchable trout, per kilometer, in the lower Flathead River and/or provide for an annual harvest of 4,000 northern pike (greater than 24 inches) in the lower Flathead River.

Fisheries Management Techniques

1. Restore, to the fullest extent practicable, major spawning tributaries to full production potential.
2. Use a stocking program to initially bring fish populations up to the targeted level. Phase out hatchery program as natural recruitment takes over.
3. Institute fishing regulations as needed to assist in restoration efforts.

Monitoring

1. Biannually make either fall or spring population estimates using electrofishing techniques to determine.
   a. numbers of fish/kilometer,
   b. numbersof hatchery fish in each year class,
   c. number of wild fish.
2. Conduct creel surveys as needed.
3. Review stocking program on an annual basis.

Impact of Alternatives

1. Hydroelectric power - the specific alternative selected would determine the impact on hydropower. The spring spawner alternative (rainbow and cutthroat trout) would restrict hydroelectric flexibility.
2. Wildlife - these alternatives are not necessarily compatible with wildlife needs. Non-operational mitigation could compensate for most negative impacts to wildlife.
3. Lake level - these alternatives could result in significant changes in summer lake levels, depending upon the particular scenario chosen, impacting boating on Flathead Lake.

MONTHLY FLOW SCENARIO ALTERNATIVES
(continued)

4. Recreation - recreational fishing opportunities in the ~min river would improve over the existing situation, however changes in lake levels during the summer could impact recreational boaters relevant to boat docking and launching.
5. Fisheries - the specific species that would benefit would be dependent on the flow scenario selected.

KERR DISCHARGE ALTERNATIVE FOR RAINBOW AND CUTTHROAT TROUT

Month (days)	Mean Monthly Discharge (cfs)	Flow Window
Oct	4,000	3,200 - 9,500
NOV	4,000	3,200 - 9,500
Dec	4,000	3,200 - 9,500
Jan	4,000	3,200 - 9,500
Feb	4 000	3,200 - 9,500
Mar	8,238	3,200 - 9,500
Apr	9,381	3,200 - 9,500
May 1-15	5,000	3,200 - 6,000
May 16-31	8,000	6,000+
Jun	15,000+	6,000+
Jul 1-15	15,000+	6,000+
Jul 16-31	9,200	3,200 - 9,500 *
Aug	6,000	3,200 - 9,500 *
Sep	9,200	3,200 - 9,500 *

Explanation: Flows from October through February address adult and juvenile trout needs. March, April and May flows and flow windows are designed to improve instream spawning conditions. June and July lower flow limits reflect incubation needs while ramping rates from 15 July through 30 September are suggested to reduce stranding of fry and fingerlings.

* A ramping rate of 1,000 cfs/l hrs is recommended on all descending flows at or below 10,000 cfs.

KERR DISCHARGE ALTRNATIVE FOR BROWN TROUT

Month	Mean Monthly Discharge (cfs)	Flow Window
Oct	5,000	4,000 - 6,000
NOV	5,000	4,000 - 6,000
Dec	9,947	4,000 - 15,000
Jan	10,000	4,000 - 15,000
Feb	10,000	4,000 - 15,000
Mar	6,500	3,200 - 6,500 *
Apr	6,500	3,200 - 6,500 *
May	8,000	3,200 - 15,000 *
Jun	12,500+	3,200 - 15,000
Jul	12,500+	3,200 - 15,000
Aug	6,748	3,200 - 15,000
Sep	9,200	3,200 - 15,000

Explanation: Flows in October and November address spawning requirements of brown trout. Flows in Decmber through February are designed for incubation while flows in May, June and July reflect spring run-off. August and September flows address juvenile and adult fish needs. Ramping rates in March, April and May are designed to reduce stranding of trout fry.

* A ramping rate of 1,000 cfs/l hrs is recommended on all descending flows at or below 10,000 cfs.

KERR DISCHARGE ALTERNATIVE FOR NORTHERN PIKE

Month	Mean Monthly Discharge (cfs)	Flow Window
Oct	9,200	3,200 - 15,000
NOV	9,200	3,200- 15,000
Dec	9,200	3,200 - 15,000
Jan	9,200	3,200 - 15,000
Feb	9,200	3,200 - 15,000
Mar	9,200	3,200 - 15,000
Apr 1-1s	9,384	8,200 - 10,000
Apr 16-30	9,384	9,000 - 10,000
May	11,500	12,400 +
Jun	19,736	15,000 +
Jul 1-1s	9,000	5,000 + 10,000 *
Jul 16-31	9,000	3,200 - 10,000 *
Aug	6,740	3,200 - 10,000 *
Sep	9,200	3,200 - 10,000 *

Explanatin: Flows from October through March address adult and juvenile fish needs. Flows in April and May meet the observed habitat needs of spawning fish for main river staging areas, access to spawning marshes, and flooding of spawning habitat. Flow windows for April and May represent operational minimums. Spring runoff is reflected in June and July flows. Flows for August and September are designed to address juvenile and adult habitat needs. Late summer ramping rates are suggested to reduce stranding of pike fry.

* A ramping rate of 1,000 cfs/l hrs is recanmended on all descendng flows at or below 10,000 cfs.

KERR DISCHARGE COMPOSITE ALTERNATIVE
FOR BROWN TROUT AND NORTHERN PIKE

Month (days)		Mean Monthly Discharge(cfs)	Flow Window	Specifics
Oct		5,000	4,000 - 6,000	spawning brown trout
Nov		5,000	4,000 - 6,000	spawning brown trout
Dec		9,500	6,000+	egg incubation
Jan		9,500	6,000+	egg incubation
Feb		9,500	6,000+	egg incubation
Mar		6,500	3,200 - 7,000	brawn trout fry
Apr	1-15	9,384	8,000+	pike spawning
Apr	16-30	9,384	9,000+	pike spawning
May		12,400	12,000+	pike spawning
Jun		15,000	12,000 - 25,000	run-off
Jul		9,500	3,200 - 15,000	rearing & adults
Aug		6,500	3,200 - 15,000	rearing & adults
Sep		6,500	3,200 - 15,000	rearing & adults

A ramping rate of 1,000 cfs/l hours is recommended on all descending flows at or below 10,000 cfs.

NON-OPERATIONAL MITIGATION

If the final selection is either the inlieu payment or the fish and wildlife trust fund alternative, there are several ways in which the monies could be spent. We have developed five non-operational mitigation alternatives. some of these alternatives require the use of a hatchery facility and others do not. It is possible that the final alternative will be a combination of a hatchery and a non-hatchery alternative.

TWO SPECIES MANAGEMENT ALTERNATIVE

Fisheries Management Goals

1. Provide for an annual harvest of at least 4,000 northern pike greater than 24 inches in that reach of the Flathead River from Moiese to Perm.
2. Establish and maintain an average of 200 catchable trout, all species combined, per kilometer in the lower Flathead River between Kerr Dam and Moiese.

Fisheries Management Techniques

1. Between Moiese and Perma, annually supplement natural reproduction by 500,000 northern pike fry or 250,000 pike fingerlings. Fish may be purchased from federal or private hatcheries.
2. Stock pike fry in July in that reach of the Flathead between Moiese and Perma.
3. Stock pike fingerlings in August in permanently wetted sloughs which have year-round access to the main river.
4. Maintain a minimum instream flow of 3,200 cfs.
5. Construct and maintain a 100,000 fish, annual capacity trout hatchery on Tribal lands.
6. Annually stock marked trout at a justifiable, predetermined density in the lower Flathead River between Kerr Dam and Moiese.
7. Allow the harvest of marked trout only in the lower Flathead River, and adjust harvest as needed on an annual basis.

Monitoring

1. Biannually estimate fall standing crop of northern pike greater than 24 inches using electrofishing techniques in that reach of river between Moiese and Perma and evaluate any trend in age and growth of all age classes.
2. Establish an index for forage fish abundance at three sites between Moiese and Perma, and monitor biannually.
3. Biannually make estimates of fall trout populations in the lower Flathead River using electrofishing gear to determine:
   a. numbers of trout per kilometer,
   b. number of marked fish in each year class, and
   c. number of unmarked (wild) fish.
4. Annually evaluate the results of monitoring and adjust goals or techniques as required.

TWO SPECIES MANAGEMENT ALTERNATIVE
(continued)

Impact of Alternative

1. Hydroelectric - should stocking be used to circumvent the impacts of peaking on fish reproduction, little impact beyond that of a minimum instream flaw constraint is expected. Should stable flows be required from 1 May through 15 June, peaking flexibility will be lost for six weeks. This may not be critical since during run-off season in the Colunbia system there is an excess of hydro-power.
2. Wildlife - inplementation of this alternative should result in more pike and trout available as forage for fish-ating birds and mammals. Increased numbers of larger pike (5-10 lbs) could result in increased predation on forage fish, ducklings and goslings along the lower river.
3. Lake Level - no change from present condition.
4. Recreation - boating opportunities will renain unchanged. Fishing opportunities would improve.
5. Fisheries - more pike surviving to three years of age, competing for the same forage base, could result in reduced growth rates of northern pike, with fewer large (l0-20 lbs) pike in the population and more fish weighing less than 10 lbs. Additionally the response of the forage base to an increase in pike numbers beyond the carrying capacity of the lower river may result in emigration of northern pike into the Clark Fork River, with undetermined consequences. In allowable harvest of trout would increase from no fish under present management to at least 2,000 fish annually from the lower river. By marking all hatchery releases, wild fish (non-marked) can be identified for release by fishermen. Increased competition between whitefish stocks and hatchery introduced trout for a limited food supply could be expected.

SUPPLEMENTAL RECRUITMENT FOR TROUT

Fisheries Management Goals

1. Establish and maintain an average of 200 catchable size trout, all species combined, per kilometer in the lower Flathead River.
2. Provide for an upward trend in numbers of wild trout over the life of the Kerr Dam license.
3. Maintain a minirrum instream flow 3,200 cfs.

Fisheries Management Techniques

1. Construct and maintain a 100,000 fish, annual capacity, trout hatchery on Tribal lands or obtain fish from private supplier or the USFWS.
2. Annually stock marked trout at a justifiable, predetermined density in the lower Flathead River between Kerr Dam and Moiese.
3. Allow the harvest of marked trout only in the lower Flathead River, and adjust harvest as needed on an annual basis.

Monitoring

1. Biannually make estimates of fall trout populations in the lower Flathead River using electrofishing gear to determine:
   a. numbers of trout per kilameter,
   b. number of marked fish in each year class, and
   c. number of unmarked (wild) fish.
2. Annually evaluate the results of mnitoring and adjust goals ortechniquesas required.

Impact of Alternative

1. Hydroelectric Power - aside from providing for a minimum instream flow this alternative is expected to have little impact upon hydroelectric production flexibility.
2. Wildlife - with hatchery supplementation more fish should be available to fish-eating mammals and birds.
3. Lake level/river flow regime - under this alternative no change in the present lake level or lower river flow regimes are expected.
4. Recreation- recreational trout fishing opportunities in river should significantly improve over the existing situation.
5. Fisheries - the allowable harvest of trout would increase from no fish under present management to approximately 2,000 fish annually fron the lower river. By marking all hatchery releases wild (non-marked) fish can be identified for release by fishermen. Increased competition between whitefish stocks and hatchery introduced trout for a limited food supply could be expected.

SUPPLEMENTAL RECRUITMENT FOR NORTHERN PIKE

Fisheries Management Goals

1. Provide for an annual harvest of at least 4,000 northern pike greater than 24 inches in that reach of the Flathead River fran Moiese to Perma.
2. Maintain a minimum instream flaw of 3,200 cfs.

Fisheries Management Technique

1. Annually supplement natural reproduction by 500,000 fry-or 250,000 fingerlings, depending on hatchery supply.
2. Purchase from federal hatcheries the needed pike fry or fingerlings for stocking.
3. Stock fry in July in that reach of the Flathead River between Moiese and Perma.
4. Stock fingerlings in August permanently wetted sloughs which have year-round access to the main river.
5. Northern pike bag and size limits, 5 fish over 24 inches, will remain in effect.

Monitoring

1. Annually estimate fall standing crop of northern pike greater than 24 inches using electrofishing techniques in that reach of river between Moiese and Perma and evaluate any trend in age and growth of all age classes.
2. Establish an index for forage fish at three sites between Moiese and Perma, and monitor annually.
3. Annually evaluate the results of monitoring and adjust goals or techniques as required.

Impact of Alternative

1. Hydroelectric Power - aside fran existing minumum instream flows no impact to hydroelectric generation is anticipated in the Flathead System due to this alternative.
2. Wildlife - implementation of this alternative should result in more pike available as forage for fish eating birds and manunals. Increased number of larger pike (5-10 lbs) could result in increased predation on forage fish, ducklings and goslings along the lower river.
3. Lake Level/Flow Regime no change fran current conditions.
4. Recreation - no change in boating opportunities. Fishing opportunities would improve.
5. Fisheries - more pike surviving to three years of age competing for the same foragebase,could result in reduced growth rates of northern pike, with fewer large (l0-20 lbs) pike in the population and more fish weighing less than 10 lbs. Additionally the response of the forage base to an increase in pike numbers beyond the carrying capacity of the lower river may result in forced emigration into the Clark Fork River, with undetermined consequences.

OFF-SITE MITIGATION

I. Jocko River

1. Fisheries Management Coals
   a. Maintain an average population density of 300 trout (all species) per mile greater than 10 inches in length, between the Jocko canal diversion and the river's mouth.
   b. Maintain an average population density of 150 trout (all species) per mile greater than 10 inches in length from the junction of the Middle and South Forks of the Jocko River to the Jocko canal.
   c. Maintain minium instream flows to fully protect the aquatic habitat needed to support identified fish population goals.

2. Fisheries Management Techniques
   a. Screen all irrigation diversions and provide fish passage where appropriate.
   b. Implement riparian land management to reduce the influence to fisheries of livestock grazing, vegetation manipulation, agriculture, housing develomt, dumping, and channel or streambank modifications.
   c. Conduct feasibility studies to determine the best management alternatives to increase habitat diversity at two channelized sites (Arlee and along the Bison Range) and stabilize the eroding west bank in the Schall Ranch area.
   d. Evaluate the need for fish stocking to achieve managementgoals.

II. MissionCreek

1. Fisheries Management Goals
   a. Maintain an average population density of 200 trout (all species) per mile greater than 10 inches in length from the confluence of Post and Mission Creeks to Mission Creek's confluence with Flathead River.
   b. Maintain an average density of 100 trout (all species) per mile greater than 8 inches in length from the Pablo Feeder Canal to the confluence of Post and Mission Creeks.
   c. Maintain minimn instream flows to fully protect the aquatic habitat needed to support identified fish population goals.

2. Fisheries Management Techniques
   a. Screen Mission B, C, H and Post F canals.
   b. Implement riparian land management to reduce the influence to fisheries of livestock, vegetative manipulation I agriculture, housing development, dumping, and channel or streambank modifications.
   c. Reduce to the greatest extent possible the sediment content of irrigation return water at Dublin Gulch, Ninepipe, and Hillside return drainages.
   d. Establish maxinum ramping rates for the delivery of irrigation water through the system.
   e. Provide for year-round fish passage, up and downstream at the Mission B and C diversion structures.
   f. Evaluate the need for fish stocking to meet management goals.

III. **PostCreek**

1. Fisheries Management Coals
   a. Maintain an average population density of 150 trout (all species) per mile greater than **8** inches throughout the stream.
   b. Maintain minixnxn instream flows to fully protect the aquatic habitat needed to support identified fish population goals.

2. Fisheries Management Techniques
   a. Screen the Pablo A canal diversion.
   b. Reconstruct the Post F diversion in such a way that waste water from Mission B is transferred to the Post F canal rather than dumped into Post Creek. Siphon is recommended.
   c. Provide year-round, upand downstream fish passage at the Post F irrigation diversion.
   d. Implement riparian land management to reduce the influence to fisheries of livestock grazing, vegetative manipulation, agriculture, housing development, duping, and channel or streanbank modification.
   e. Evaluate the need for hatchery supplementation to meet management goals.

Iv. **Little Bitterroot River**

1. Fisheries Management Goals
   a. Maintain an average population density of 50 trout (all species) per mile greater than 8 inches in length, between Hubbart Dam and the Carnas A diversion.
   b. Eliminate, to the greatest extent possible the sediment load entering the Flathead River from the Little Bitterroot River.

c. Maintain minimum instream flows throughout the Little Bitterroot River to fully protect aquatic habitat needed to support identified goals.

2. Fisheries Management Techniques
   a. Conduct a feasibility study to determine if a sediment control dam built at the mouth of the Little Bitterroot River would be effective in reducing sediment input into the Flathead River and determine the amount of water that might be available from such a reservoir to agricultural interests. Investigate warm water fisheries potential.
   b. Screen the Camas A canal.

V. Crow Creek

Fisheries Management Goal

By 1991 restablish and maintain a viable fishery for naturally reproducing rainbow trout and brown trout in Crow Creek from Crow Dam to the Flathead River.

Fisheries Management Techniques

1. Spawning Gravel
   a. Size 2.5 - 4 cm
   b. To be introduced below Crow Dam on an annual basis for five years and there afteras determined by Tribal Fisheries Staff.
   c. Introduced gravel will be sorted by stream discharges.
   d. Amount of gravel to be determined.

2. Instream Flows
   a. Maintain a minimum instream flow past the Moiese diversion of 21 cfs. Study completed 5-9-85.

3. Stocking
   a. The stream will be restocked with rainbow trout and brown trout fingerlings in a 3:l ratio for 5 years.
   b. All stocked fish will be marked to aid in monitoring efforts.
   c. Stocking will be conducted above and below Moiese diversion.

4. Sediment
   a. Conduct a feasibility study to determine methods to significantly reduce sediment content of irrigation return water.
      1. Sediment settling ponds
      2. Riparian filtration

b. Implementriparianlandmanagemntto reduce the influence to fisheries of livestock, vegetative manipulation, agriculture, housing development, dumping, and channel or streartbank modifications.

5. Monitoring
   a. Sampling at 3 permanent sites will be conducted yearly for five years and thereafter every third year by the Tribal fishery staff, BIA and USFWS.
   b. Population estimates, year class structures, number of marked fish, and gravel quality will be determined.
   c. Analyze results of monitoring and adjust management strategies as needed.

6. Regulations
   a. Close fishing until monitoring determines populations can withstand fishing pressure.

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